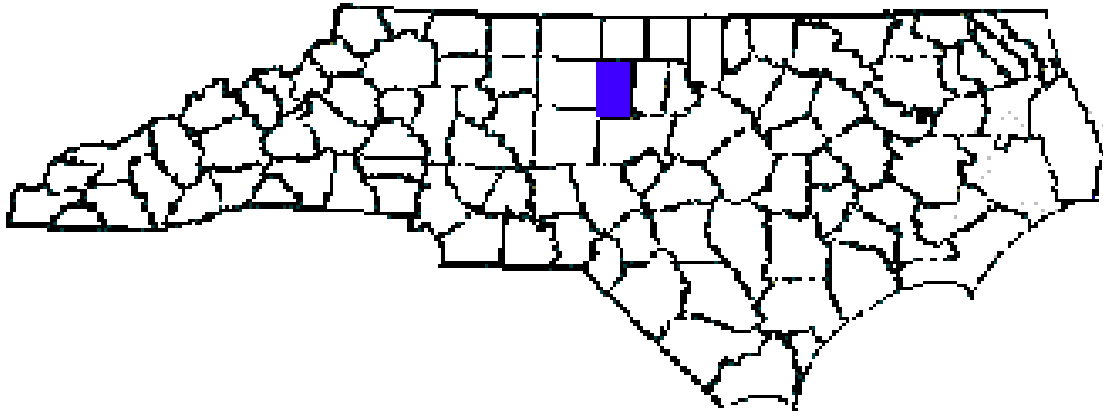


# ANNUAL REPORT FOR 2009



**Michael's Branch Mitigation Site**  
**Alamance County**  
**TIP No. U-3110A**



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North Carolina Department of Transportation  
September 2009

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## **SUMMARY**

The following report summarizes the stream monitoring activities that have occurred during the Year 2009 at the Michael's Branch Mitigation Site in Alamance County. This site was constructed during 2003 by the North Carolina Department of Transportation (NCDOT). The permit conditions require that stream monitoring be performed for a duration of five years with data to be collected and submitted in the 1<sup>st</sup>, 3<sup>rd</sup>, and 5<sup>th</sup> years after construction was completed. This report provides the monitoring results for the third formal stream stability assessment (Year 2009). The Year 2009 monitoring period was the third of three required evaluations during the five year monitoring period on Michael's Branch (See Success Criteria Section 2.1).

Based on the overall conclusions of monitoring at Michael's Branch, it has met the required monitoring protocols for the third assessment during the monitoring period. The structures are stable and while the channel has experienced some change the streambanks remain stable with woody vegetation. The streambank and buffer area are highly vegetated for the fifth year of monitoring.

NCDOT proposes to discontinue stream monitoring at the Michael's Branch Site.

## **1.0 INTRODUCTION**

### **1.1 Project Description**

The following report summarizes the stream monitoring activities that have occurred during the Year 2009 at the Michael's Branch Mitigation Site. The site is located just north of Interstate 40 on University Drive in Alamance County (Figure 1). The Michael's Branch Site was constructed to provide mitigation for stream impacts associated with Transportation Improvement Program (TIP) number U-3110A in Alamance County.

The mitigation project covers approximately 780 linear feet of channel length. Construction was completed during 2003 by the NCDOT. Stream restoration involved the installation of cross vanes, dual fiber logs, sloping the adjacent streambanks to promote stability, and widening of the floodplain to allow for major flood events. It also included the installation of coir fiber matting and live stakes along the streambank and bareroot seedlings in the buffer area.

### **1.2 Purpose**

In order for a mitigation site to be considered successful, the site must meet the success criteria. This report details the monitoring in 2009 at the Michael's Branch Mitigation Site. Hydrologic monitoring was not required for the site.

### **1.3 Project History**

December 2003	Construction Completed
February 2005	Planted Live Stakes and Bareroot Seedlings
September 2005	Stream Channel Monitoring (Year 1 Assessment)
June 2007	Stream Channel Monitoring (Year 3 Assessment)
September 2009	Stream Channel Monitoring (Year 5 Assessment)

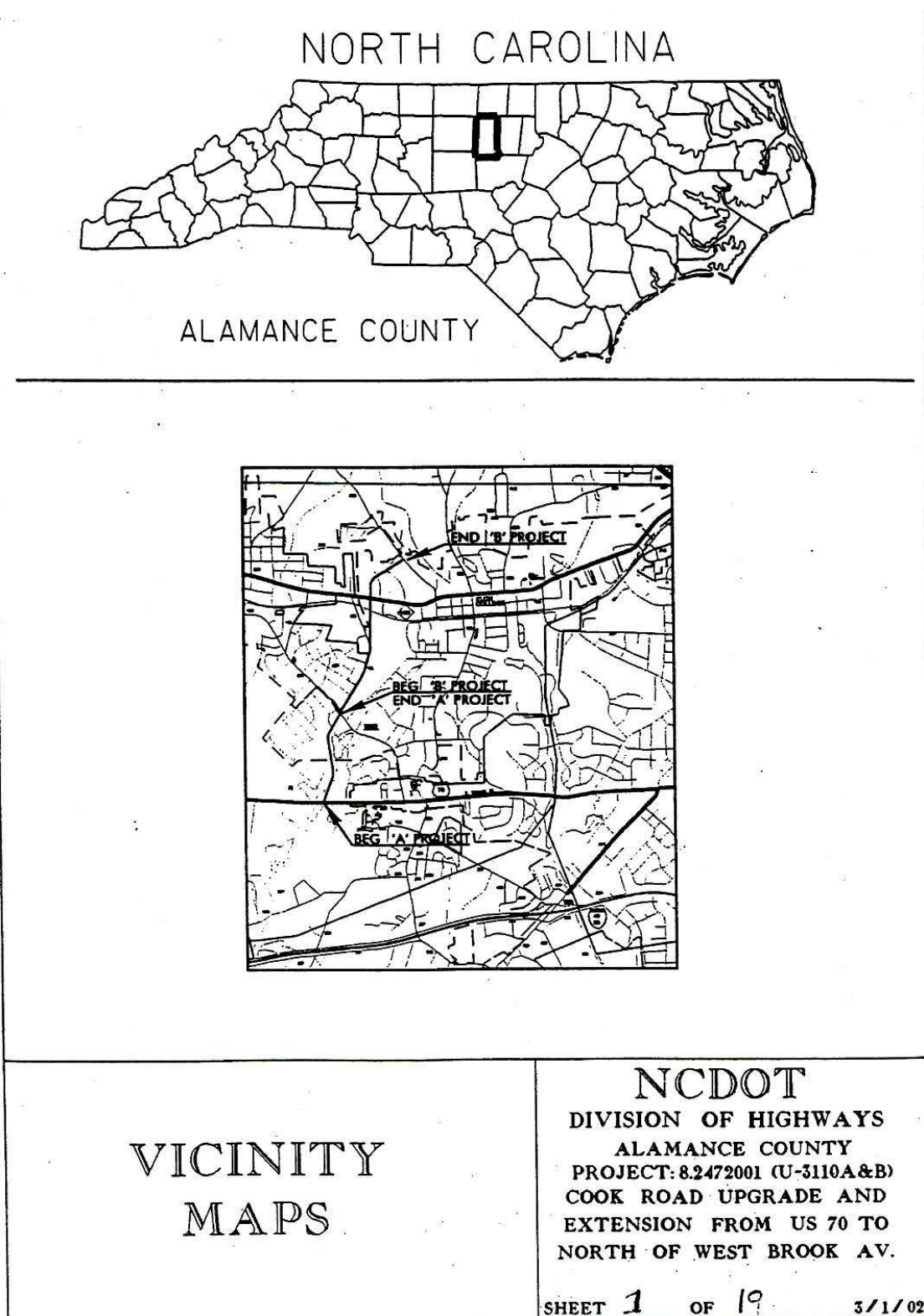


Figure 1.0 Vicinity Map

## **2.0 STREAM ASSESSMENT**

### **2.1 Success Criteria**

The following surveys were conducted in support of the monitoring assessment:

#### **Stream Geomorphological Assessment**

- ◆ The stream shall be monitored for a duration of 5 years from end of construction (channel modifications and vegetation planted)
- ◆ The data shall be collected and submitted to the NCDWQ and the US Army Corp of Engineers in the 1<sup>st</sup>, 3<sup>rd</sup>, and 5<sup>th</sup> years after construction
- ◆ The stream dimension shall be measured using permanent cross-sections (surveyed or GPS) established at a distance of 1 per every 20 bankfull-widths
- ◆ The measurements for dimension shall include a measurement of the stream width/depth ratio, entrenchment ratio, and low bank height ratio (low bank height/max. bankfull depth)
- ◆ The stream pattern shall be ascertained through measurements of stream sinuosity, meander width ratio, and radius of curvature (on newly constructed meanders only 1<sup>st</sup> year monitoring)
- ◆ The stream profile shall be ascertained by measurement of stream slope including the average pool and riffle slope as well as the overall stream slope, and the pool to pool spacing
- ◆ Pebble Counts for the stream shall be performed and presented to NCDWQ

#### **Stream Vegetative Assessment**

- ◆ Riparian buffers must be planted to achieve such that the survival of 260 stems/acre for trees after five years is attained. Tree densities of less than the prescribed amount will necessitate remedial actions by NCDOT.

### **2.2 Stream Description**

#### **2.2.1 Post-Construction Conditions**

The mitigation of Michael's Branch involved the construction of rock cross vanes, installation of dual fiber logs, and additional bank sloping. Cross vanes were installed between glides and riffles. Coir fiber matting was installed along the banks throughout the entire reach.

#### **2.2.2 Monitoring Conditions**

The objective of the Michael's Branch stream restoration was to build a C6 stream that has the potential to develop into an E5 stream as identified in the

Rosgen's Applied River Morphology. A total of two cross sections (one in a riffle and one in a pool) were surveyed. For this report, only cross sections containing riffles were used in the comparison of channel morphology presented below in Table 1. Data shown in Table 1 includes one cross section chosen to represent a riffle section.

**Table 1.0 Cross-section Data**

Variable	Proposed	2005	2007	2009
		Cross-Section #1	Cross-Section #1	Cross-Section #1
Drainage Area (mi <sup>2</sup> )	1.5	1.5	1.5	1.5
Bankfull Width (ft)	25.0	21.8	22	25.21
Bankfull Mean Depth (ft)	1.2	1.2	1.3	1.32
Width/Depth Ratio	20.8	18.14	17.04	19.1
Bankfull Cross Sectional Area (ft <sup>2</sup> )	29.7	26.19	28.24	33.23
Maximum Bankfull Depth (ft)	0.6	2.22	2.86	3.43
Width of Floodprone Area (ft)	>50	37.5	37.5	37.5
Entrenchment Ratio	>2.2	1.72	1.71	1.49
Thalweg Slope	0.003	0.005	0.006	0.006

\*Drainage Area, Floodprone Width, and Slope are averaged values only.

\*Riffle values are used for classification purposes, pool values are shown in Appendix A.

Particle Sizes (Reach Count)	Proposed	2005	2007	2009
D <sub>16</sub> (mm)	N/A	1.14	1.78	1.1
D <sub>35</sub> (mm)	N/A	4.85	0.92	5.7
D <sub>50</sub> (mm)	N/A	8	1.78	9.65
D <sub>84</sub> (mm)	N/A	15.79	14.43	23.64
D <sub>95</sub> (mm)	N/A	40.67	21.94	45

## 2.3 Results of the Stream Assessment

### 2.3.1 Site Data

The assessment included the survey of two cross sections and the longitudinal profile of Michael's Branch established by the NCDOT after construction. The length of the profile along Michael's Branch was approximately 250 linear feet. Two cross sections were established during the 2005 monitoring year. Cross section locations were subsequently based on the stationing of the longitudinal profile and are presented below. The locations of the cross sections and longitudinal profiles are shown in Appendix A.

- ◆ Cross-Section #1. Michael's Branch, Station 180.4 linear feet, midpoint of riffle
- ◆ Cross-Section #2. Michael's Branch, Station 225.5 linear feet, midpoint of pool

Based on comparisons of Year 2005 to Year 2009 monitoring data, both cross sections have experienced some degradation within the channel. Graphs of the cross sections are presented in Appendix A. Future survey data will vary depending on actual location of rod placement and alignment; however, this information should remain similar in appearance.

The longitudinal profile shows that the channel has experienced some degradation along the profiled reach but the streambanks remain stable with woody vegetation. A beaver dam that was located at Station 128+00 along the profiled reach was breached prior to completing the longitudinal profile survey. There were two other beaver dams located onsite downstream of the profiled channel that were also breached. NCDOT has contracted the N.C. Department of Agriculture to manage the site for beaver activity.

A representative pebble count was taken throughout the surveyed reach. This information is used to determine the stream type. Pre-construction data was not available for Michael's Branch. The pebble counts taken during the Year 2005 monitoring period noted that the  $D_{50}$  (50 percent of the sampled population is equal to or finer than the representative particle diameter) for the entire reach of Michael's Branch was approximately 8 mm, which is indicative of a gravel-bed stream.

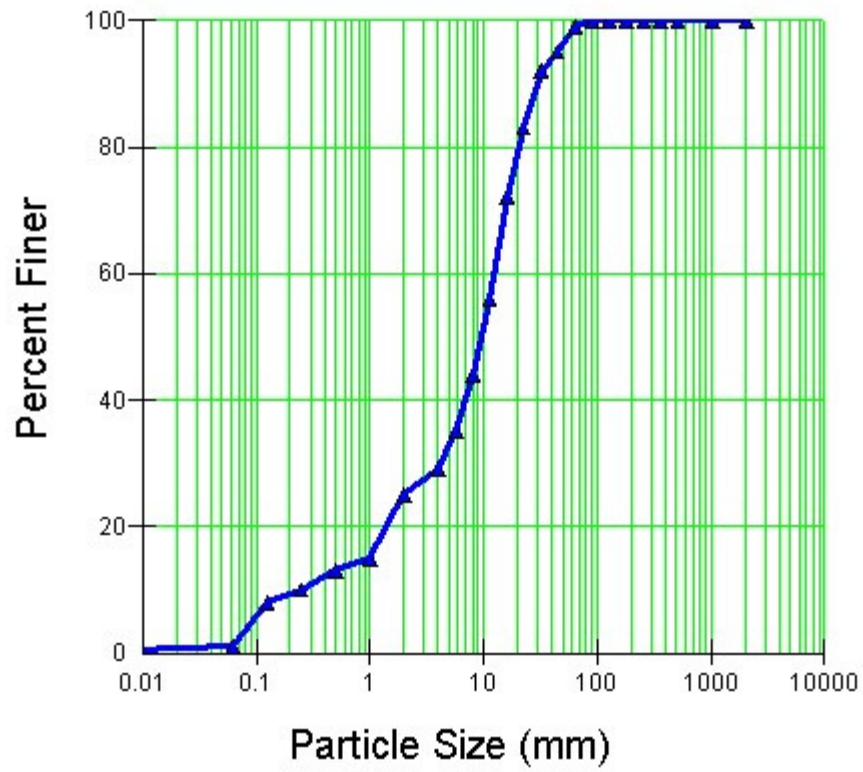
The Year 2007 representative pebble count for Michael's Branch indicated a  $D_{50}$  of approximately 1.78 mm for the entire reach, which is, indicative of a sand-bed stream. Since no active bank erosion was observed on site, the increase in accumulation of finer material from 2005 to 2007 may be attributed to increased stream flow. Approximately four bankfull events were documented from September 2005 to present by quarterly monitoring evaluations under the Army Corp of Engineers permit. The increased stream flow could have distributed the finer material on site.

The Year 2009 representative pebble count for Michael's Branch indicated a  $D_{50}$  of approximately 9.65 mm for the entire reach, which is, indicative of a gravel-bed stream. Due to some degradation that has occurred since 2007 within the channel and the bankfull events that occurred, the finer particles have been deposited downstream and onto the floodplain. This in turn has caused the stream type to return to a gravel-bed stream.

A chart depicting the particle size distributions for Michael's Branch for the Year 2009 is presented below.



## Michael's Branch Pebble Count



## 2.4 Results of Stream and Buffer Vegetation

### 2.4.1 Description of Species

The following tree species were planted on the stream bank:

*Salix nigra*, Black Willow

*Cornus amomum*, Silky Dogwood

The following tree species were planted in the buffer area:

*Betula nigra*, River Birch

*Platanus occidentalis*, Sycamore

*Nyssa sylvatica* var. *sylvatica*, Blackgum

*Liriodendron tulipifera*, Tulip Poplar

*Fraxinus pennsylvanica*, Green Ash

### 2.4.2 Results of Vegetation Monitoring

**Streambank Vegetation:** The stream is highly vegetated throughout the channel with black willow, silky dogwood, and tag alder. Other wetland grasses noted along the channel are *Juncus* sp., woolgrass, cattail, jewelweed, and various grasses.

**Buffer Vegetation:** One vegetation plot was set to determine the trees per acre in the buffer area. There were no at planting counts conducted so therefore it is assumed that 39 total trees were planted in the 50 ft. x 50 ft. plot.

Plot #	River Birch	Sycamore	Blackgum	Tulip Poplar	Green Ash	Total (3 year)	Total (at planting)	Density (Trees/Acre)
1	1	9	1	4	8	23	39	401
Average Density (Trees/Acre)								401

**Site Notes:** Other vegetation noted: green briars, multi-flora rose, fennel, goldenrod, tag alder, willow oak, black willow, silky dogwood, sedge, and various grasses.

#### **2.4.3 Conclusions**

There was only 1 vegetation monitoring plot established throughout the 1.97 acre planting area. The 2009 vegetation monitoring of the site revealed an average tree density of 401 trees per acre. This average is above the minimum success criteria of 260 trees per acre for year five monitoring.

### **3.0 OVERALL CONCLUSIONS**

The Michael's Branch Site has met the required monitoring protocols for the third formal year of monitoring. The structures are stable and while the channel has experienced some change, the streambanks remain stable with woody vegetation present. The streambank and buffer area is highly vegetated for the third year of monitoring. NCDOT proposes to discontinue stream monitoring at the Michael's Branch Site.

## **4.0 REFERENCES**

North Carolina Department of Transportation (NCDOT), October 22, 2002.  
Permit for Cook Road Connector (U-3110A).

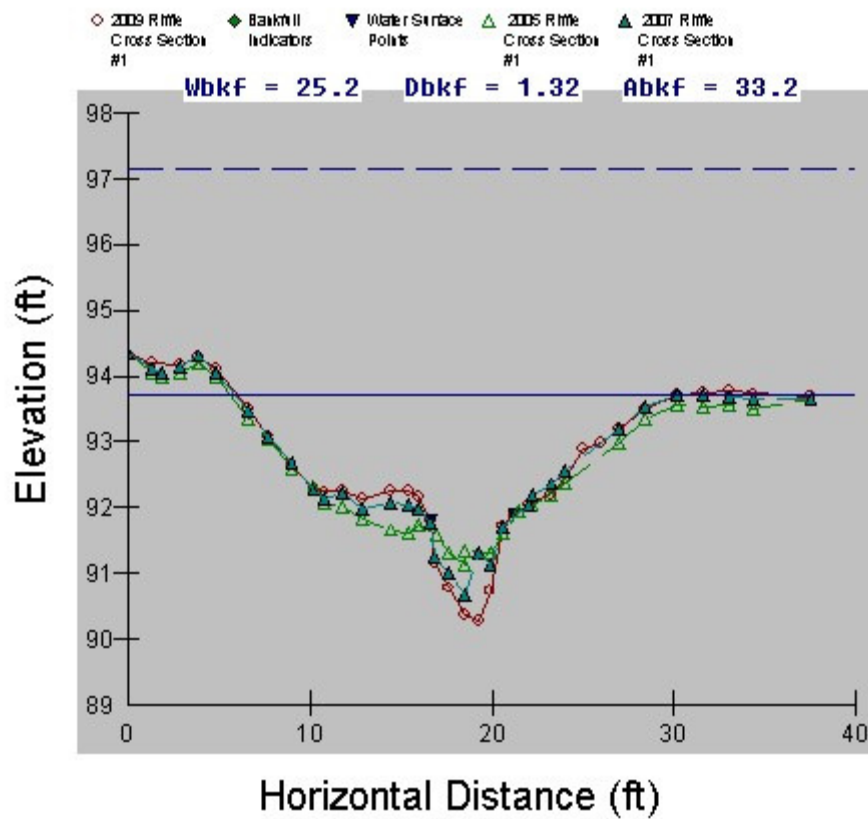
Rosgen, D.L, 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, Colorado.

US Army Corps of Engineers (USACE), 2003. Stream Mitigation Guidelines.  
Prepared with cooperation from the US Environmental Protection Agency,  
NC Wildlife Resources Commission, and the NC Division of Water Quality.

## **APPENDIX A**

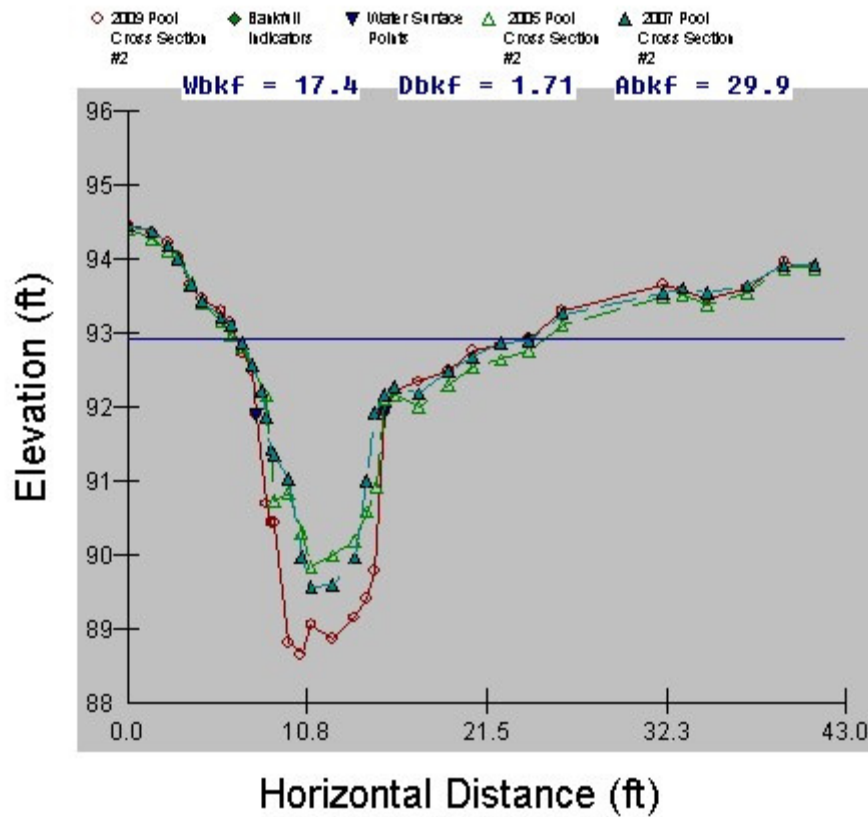
### **CROSS SECTIONS AND THE LONGITUDINAL PROFILE COMPARISON**

## Riffle Cross Section #1



Cross-Section #1 (Riffle) Abbreviated Morphological Summary			
	2005	2007	2009
Bankfull Cross Sectional Area (ft <sup>2</sup> )	29.7	28.2	33.23
Maximum Bankfull Depth (ft)	2.22	2.86	3.43
Width of the Floodprone Area (ft)	37.5	37.5	37.5
Bankfull Mean Depth (ft)	1.2	1.3	1.32
Width/Depth Ratio	18.14	17.04	19.1
Entrenchment Ratio	1.72	1.71	1.49
Bankfull Width (ft)	21.8	22	25.21

## Pool Cross Section #2

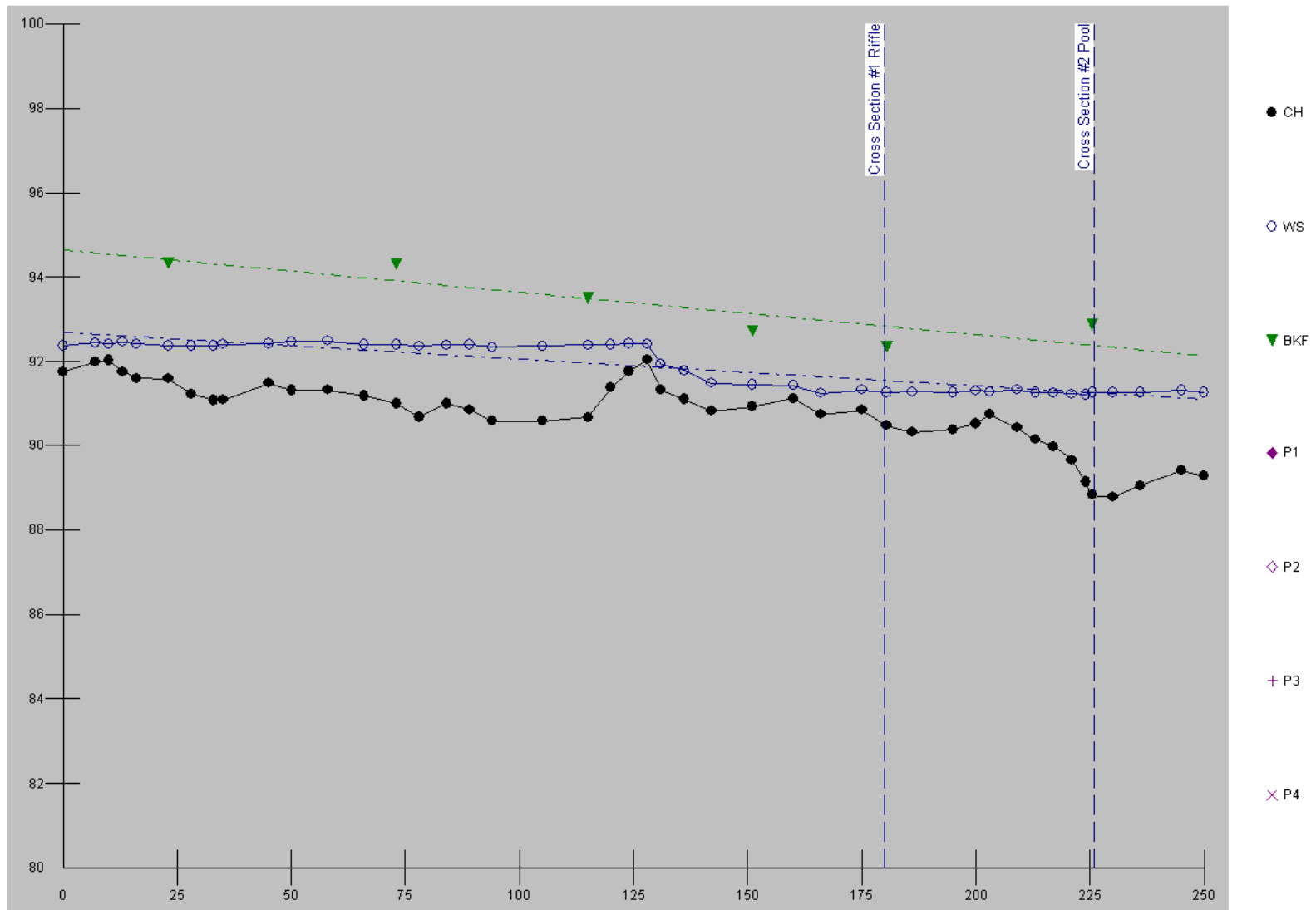


**Cross-Section #2 (Pool) Abbreviated Morphological Summary\***

	2005	2007	2009
<b>Bankfull Cross Sectional Area (ft<sup>2</sup>)</b>	26.69	27.61	29.86
<b>Maximum Bankfull Depth (ft)</b>	3.28	3.7	4.27
<b>Bankfull Mean Depth (ft)</b>	1.32	1.34	1.71
<b>Bankfull Width (ft)</b>	20.28	20.65	17.44

\* According to the Rosgen Classification of Natural Rivers floodprone width, entrenchment ratio, and width depth ratio are not measured in pool, glide, or run features.

# Michael's Branch





## **APPENDIX B**

### **SITE PHOTOGRAPHS AND SITE MAP**

# Michael's Branch



PP #1 (Upstream-East of University Drive)



PP #2 (Downstream-West of University)



PP #3 (Upstream-Cross Section #1)



PP #3 (Downstream-Cross Section #1)



PP #4 (Upstream-Cross Section #2)



PP #4 (Downstream-Cross Section #2)

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# Michael's Branch



PP # 5 (Upstream-North of Sub-division Bridge)



PP #5 (Downstream-North of Sub-division Bridge)



PP #6 (Upstream-South of Sub-division Bridge)



PP #6 (Downstream-South of Sub-division Bridge)



PP#7 (Overview of Site Looking Downstream Towards the Sub-division Bridge)

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# Michael's Branch



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